02 P 11895

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PCT

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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :
H04L 12/28, 12/40

A2

(11) International Publication Number: WO 99/16213

(43) International Publication Date: 1 April 1999 (01.04.99)

(21) International Application Number: PCT/SE98/01661

(22) International Filing Date: 17 September 1998 (17.09.98)

(30) Priority Data:
9703442-5 24 September 1997 (24.09.97) SE

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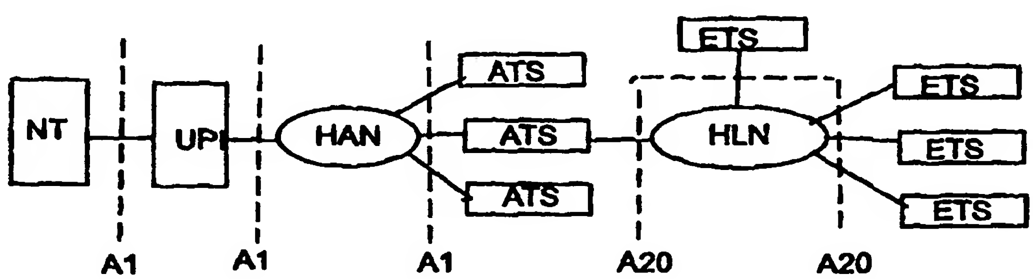
(81) Designated States: EE, JP, LT, LV, NO, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
Without international search report and to be republished upon receipt of that report.

(54) Title: FIRST AND SECOND NETWORK SHARING A COMMON TRANSMISSION TECHNOLOGY OVER THE SAME PHYSICAL BUS



(57) Abstract

The invention relates to the use of one transmission technology for both Home Access Network and Home Local Area Network. The technology that is used for this is IEEE 1394, which carries two DAVIC logical networks over the same physical bus. With this transmission technology a home user can simultaneously watch multiple movies, have a video conference and still have capacity available for internal and external services.

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TITLE OF INVENTION:

FIRST AND SECOND NETWORK SHARING A COMMON TRANSMISSION TECHNOLOGY OVER THE SAME PHYSICAL BUS

FIELD OF INVENTION

The present invention relates to a transmission system comprising a first network and a second network.

PRIOR ART

Most actors in telecommunication and home electronic industry believe in a future digital multimedia network in the home, which network interconnects all electronic equipments as for example PC, Set-Top Box, DVD-player, stereo etc.

The standardisation of a future home network is at present discussed in DAVIC but for the moment the discussions only concern which physical media are to be used.

In the following DAVIC is briefly discussed with reference to Figure 1.

DAVIC has defined two networks for the Service Consumer System (Home environment), the Home Access Network (HAN) and the Home LAN (HLN) as can be seen in Figure 1. Discussions so far have lead to the assumption that ATM is to be carried over the HAN, but probably not over the HLN.

Access Termination System (ATS) devices are connected to the HAN, and must by definition understand the access network protocol. Hence, for an ATM system the ATS is ATM capable. The End Termination Systems (ETS) are simpler devices, which need to go through an ATS when communicating with the access network.

The User Premises Interface (UPI) supports the connection of multiple ATS equipment to the access network. It provides media conversion between the access network and the home network.

As mentioned above a frequently discussed problem today is how to design the future digital home network, excepted to be used both for applications within the home and for external applications. It is not efficient to have two

different transmission technologies for the home environment consisting of HAN and HLN.

Thus, the object of the present invention is to solve this problem.

SUMMARY OF INVENTION

The above mentioned object is achieved by a transmission system comprising a first network and a second network, wherein said both networks share one and the same transmission technology, which technology carries both said networks over the same physical bus.

It is proposed that ATM be transported over IEEE 1394 and terminated in devices acting as ATSs. It is also recommended that ATM cells be transported both in isochronous packets and in asynchronous packets, depending on the requested ATM service category.

With the architecture proposed in the present invention, an efficient and scalable solution for the home network is achieved, with a minimal amount of control procedures. A home user can simultaneously watch multiple movies, have a video conference and still have capacity available for other internal or external services. This will probably satisfy the requirements of the majority of households.

Other characteristics of the present invention are disclosed in the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described, by way of examples, with reference to the accompanying drawings, in which:

Figure 1 is a DAVIC home network according to prior art;

Figure 2 is a scenario for the home environment according to the present invention;

Figure 3 discloses ATM cells in asynchronous write packets;

Figure 4 discloses asynchronous write packets of IEEE 1394;

Figure 5 is mapping tables;

Figure 6 is the protocol architecture between the ATS and the ATM switch of the core;

Figure 7 discloses ATM in isochronous packets;
Figure 8 discloses a MPEG-2 over ATM.

BEST MODE OF CARRYING OUT OF THE INVENTION

As mentioned before, it is not efficient to have two different technologies for the home environment consisting of the HAN and HLN. The invention proposes that both the HAN and HLN share the same transmission system. The suitable system for this is the IEEE 1394, which can be used to carry the two logical networks over the same physical bus as exemplified in Figure 2. Figure 2 discloses an example of a physical configuration scenario for home environment. It is to be observed that the Residential Gateway (RG) consists of functional elements UPI and NT.

ATM will be used on the HAN and terminated at the ATS which is an ATM capable terminal. It could also be utilised in the HLN for intra-home applications but this is outside the scope of this invention. The main task for the UPI will in this case be to relay ATM cells between the access network and the IEEE 1394 bus. Another important task of the UPI is to provide traffic management functionality outlined later. This is performed by using separate cell buffering for each supported service category (e.g. CBR, UBR). Below, we make frequent use of the term RG (Residential Gateway) denoting a device built of the logical entities NT and UPI.

ATM cells are transported between the RG and the ATSs, thus creating a logical ATM HAN. Other devices (ETS) are connected to the same physical network, but have to go through an ATS to communicate with the access network. Logically, such a device exists on the HLN.

To use the bandwidth of the IEEE 1394 bus as efficient as possible the delay sensitive ATM service categories (e.g. CBR, real-time VBR) are transmitted in isochronous packets and non real-time traffic (e.g. UBR) in asynchronous packets.

Already existing DAVIC specifications specify how ATM cells shall be carried in IEEE 1394 isochronous channels. Figure 3 depicts one possible solution to transport ATM cells in asynchronous write packets.

Each ATS is assigned an ATM address and a VPC (Virtual Path Connection) that terminates at the ATM switch of the core. The ATM address may by an E.164 or an ATM-Forum NSAP address of E.164 format. For the latter case, the world-wide unique 64-bit ID (EUI-64) of the ATS could be used for the DSP (Domain Specific Part) of the NSAP address. However, this is a subject for further studies.

The RG multiplexes the VPs onto a single physical UNI towards the access network. Associated signalling of Q.293 is applied on the VPs. Accordingly, at the user side signalling messages are carried on VPI=X and VCI=5 and ILMI (Integrated Local Management Interface) messages from the ATSs are transported on VPI=X and VCI=16. These messages use the UBR service category, which is transmitted in asynchronous packets. On the switch side, a unique VPI distinguishes between individual users. In UNI 4.0 this configuration is referred to as virtual UNIs. The RG is entirely transparent for the signalling and ILMI messages.

The call control entities reside at the ATS and the core ATM switch. As for ILMI, the ATS and the switch implement the user IME (Interface Management Entity) and the network IME respectively. ILMI provides the auto configuration of many ATM parameters including the ATS's ATM address and a service registry with ATM addresses to serves of various kinds. This registry also provides a simple mechanism for the core ATM switch to communicate addresses to new services to the ATS. When the ATS starts up, the ILMI connectivity is established between these entities and tested periodically through the ILMI link management procedures. If NSAP addressing is used, ILMI delivers the network prefix of each address while the ATS supplies its EUI-64.

Since the number of isochronous channels of the IEEE 1394 bus is limited (i.e. 64), it is not appropriate to allocate two channels for each bi-directional real-time VC (Virtual Circuit) being established in the HAN as the home network would soon run out of channels. Instead, all real-time VCs of the ATS are transported by two isochronous channels, one for each direction. The establishment of these channels are accomplished by the ATS which then instructs the RG to

modify its plug registers, by using a simple connection control message. The message is exchanged between the Connection Management Entity (CME) of the ATS and its peer at the RG. It contains the following fields: output_plug (index at RG), channel_nr (downstream), exist bit indicate whether the payload value is valid, payload input_plug (index at ATS for upstream). How these fields will be utilised is described later. The message is convoyed in the acknowledged asynchronous write message as depicted in Figure 4. Figure 4 discloses the connection control message carried by the asynchronous write packet of IEEE 1394.

If the total bandwidth of the VCs in a channel exceeds the allocated isochronous bandwidth, the ATS allocates more bandwidth and instructs the RG to modify the payload field of the corresponding output plug, by using the connection control message.

To avoid having control messages exchanged between the ATS and the RG indicating the service category of each established VC, it is proposed that the VCI domain in each VP be partitioned into a number of portions, each dedicated for a specific service category. For instance, VCI values between 35 and 60 may be devoted for CBR VCs. This enables the RG to conclude the service category of each VC based on its VCI value. The assignment of VCI values is done by the ATS for both network initiated and ATS initiated ATM connection. To indicate the required VCI value, the ATS relies on the preferred/exclusive and VCI fields of the connection identifier information element of the call messages. If the above method is not adopted, a simple protocol can be defined between the CME of ATS and its peer at the RG to indicate the service category for each established VC.

Besides performing network management tasks, RG's key function is traffic handling. Predefined VCI ranges enable the RG to handle cell streams according to their service categories. CBR traffic gets the highest priority and is always transmitted first. At minimum, two cell buffers for each direction are maintained by the RG, one for CBR and the other for UBR. The CBR buffer has space for one hundred cells whereas the UBR buffer has space to store at least one

thousand cells. The RG may also perform a packet discard mechanism for UBR traffic. The ATS performs traffic shaping for each CBR/VBR VC. For each requested VC, the switch performs connection admission control and reserves the resources required in the access network by using network management or some proxy mechanism. Traffic policing is performed by the access node that receives the parameters to be policed from the switch.

The RG maps CBR traffic to isochronous channels towards the ATS, and the UBR traffic to asynchronous packets to the destination Node ID of the ATS. It is a simple VP multiplexer transparent for signalling and ILMI traffic between the ATS and the switch. From the outset, the RG is configured with a number of permanent VPCs (e.g. 6) set-up by the switch through network management. When a new ATS is plugged in, it gets a VPC from the RG using a very simple procedure described below. This VPC is used for all communication between the ATS and the switch. The VPC is up as long as there is ILMI connectivity between the ATS and the switch. It is assigned an isochronous channel only when one or more of its VCs are of CBR or real-time VBR type.

SYSTEM DESCRIPTION

The following is described by reference to Figure 5, which discloses mapping tables at different systems.

The RG has a number of VP connections set up between itself and the ATM switch. The number of VPCs should be sufficient for the ATSs. For each VP the RG finds an output/input plug. These plugs will reserved for VP links to ATSs. The plug index is identical to the VPI value to be used for this plug in the home network. Since the plug index is unique at the RG, so is the VPI value. To indicate that these plugs are reserved (but not yet allocated), the point to point field is set to 63 (dummy value) and the on-line bit is set to zero (off-line). The plug is then in a suspended mode.

Upon each bus reset the RG broadcasts an RG identification message to tell the ATS devices its current Node ID. For this purpose the RG relies on the asynchronous write

request destined to the local bus broadcast ID of 0×3FF and 6 bit physical ID of 0×3F. The destination offset of the message is the CME of the ATSs. Another, but less flexible solution to identify the RG is that the ATS is preconfigured with the unique 64 bit ID (EUI-64) of the RG.

The RG maintains a table that relates VPI to Node ID and plugs. The table also describes the service category of established VCs, see Figure 5.

ATS INITIALISATION

At system start-up the ATS obtains one of the reserved VP links for traffic towards the RG. First it finds a free output plug (VPI) on the RG by reading the on-line bit and the point_to_point field. When it finds an off-line output plug with the point_to_point value of 63 it sends the connection control message to the RG. The fields in the message have the following values:

- output plug index (VPI) = the index of the found output plug
- channel = XX (no meaning)
- exist = 0 (no payload exist)
- payload = XX
- input plug index = XX

The message tells the RG that the ATS requests this plug (VPI), but no isochronous channel is allocated yet. When receiving the message, the CME of the RG checks if the output plug index is still free, and if so it zeroes the point_to_point field, sets the on-line bit and stores the VPI and the Node ID of the ATS in its mapping table. The plug is then in "Ready" mode. The Node ID is found in the source ID of the asynchronous packet. Finally it returns an identical message indicating a successful allocation.

If the plug is already reserved, the RG sends back the same message, but with the output plug index set to zero, which indicates a non successful allocation. These messages are sent in an acknowledged mode. If the VPI allocation fails the ATS will try to find another VPI.

When the VPI is established the ILMI IME at the ATS contacts its peer at the switch by sending coldStart Trap.

It then tries to establish ILMI connectivity. The ATS is also assigned an ATM address by the switch.

Now the ATS can set up VCs using the VP associated signalling of Q.2931. For UBR traffic the ATS does not need to set up any isochronous channel.

VC SET-UP/TEAR-DOWN

The following sections outline the procedures for how new VCs are established for UBR and CBR as well as how the ATS shall act upon a bus reset.

Connection set-up of an UBR VC when the ATS is the originator

The ATS sends the call set-up message in which the connection identifier information element carries exclusive VPI/exclusive VCI. The VCI value is chosen from the predefined VCI range for UBR (e.g. 70). Of course, the ATS has to be aware of how the RG has partitioned the VCI range with respect to traffic management. The RG is entirely transparent for signalling messages. The switch assigns the requested VCI.

The RG maps the incoming response messages in VPI=X, VCI=5 to asynchronous packets and send them to the Node ID of the ATS.

The ATS can now use the new VCI for UBR traffic. The ATS and the RG maps the new VCI to asynchronous packets, according to the predefined mapping between VCI range and service category.

Connection set-up of an UBR VC when the ATS is the destination user

The switch uses the exclusive VPI/ any VCI in the call SET-UP message to ask the ATS for which VCI to assign for the connection. The ATS finds out that the set-up request is for UBR traffic and chooses an available VCI value, predefined for UBR (e.g. 75). The selected value is indicated in the first message returned by the ATS in response to the SET-UP message (e.g. the connection identifier information element of the CALL PROCEEDING message).

The ATS can now use the new VCI for UBR traffic. The ATS and the RG map the new VCI to asynchronous packets.

Connection set-up of a CBR VC when the ATS is the originator

The signalling procedures for CBR VCs are the same as for UBR. The difference is that an isochronous channel with the specific bandwidth needs to be allocated.

First of all the ATS must allocate a channel and the needed isochronous bandwidth for each direction. This is done by lock request messages with an extended transaction code of compare and swap to the BANDWIDTH_AVAILABLE register at the isochronous resource manager. Available input output plugs on the ATS are selected and their on-line bits are set. The ATS establishes the upstream channel by connecting its output plug to the RG input plug, reserved for the ATS VP links. It then instructs the RG to connect the RG output plug to the ATS input plug indicated in the connection control message. The message also carry the channel number and the payload to be used for the connection.

When the connections are established the ATS starts signalling towards the ATM switch. The set-up of channels and plugs may also be done during the ATM call set-up procedure.

The establishment of the ATM connection follow the same procedure as for UBR, except that the VCI value is chosen from the CBR VCI range.

The ATS can then use the new VCI for CBR traffic. The ATS and RG map the new VCI to isochronous packets according to the predefined mapping between VCI range and service category. Traffic shaping on the VC is performed by the ATS.

Connection set-up of a CBR VC when the ATS is the destination user

The establishment of the ATM connection follow the same procedure as for UBR, except that the VCI value is chosen from the CBR VCI range.

The ATS receives the SET-UP message in VPI=X and VCI=5 and finds out that the request is for a CBR connection with a specific bandwidth found in the traffic descriptor.

It will then try to allocate isochronous bandwidth to the connection(s) between the RG and the ATS. If this succeeds the connection request can be accepted. The ATS establishes the required connections over the IEEE 1394 bus following the same procedures as above.

Establishing an additional CBR VC

The same procedure of call set-up described earlier is applied. If the required bandwidth does not exceed the previously allocated bandwidth of the isochronous channel(s), no new isochronous resources need to be allocated.

Otherwise the ATS allocates more bandwidth to the already established channel(s), modifies the payload filed of its own output plug and finally instructs the RG to modify its output plug, using the connection control message.

To modify the payload field both the ATS and the RG must first zero their point_to_point fields, change the payload and re-establish the connections. This procedure may take 2-4 isochronous cycles (< 0.5 ms).

Closing CBR connection

If the VC is the only established CBR connection the ATS tears down the upstream connection, instructs the RG to tear down the downstream connection and finally deallocates the isochronous resources.

If the CBR connection is not the last one the payload fields at the RG and ATS is modified as described in the previous section. The accessive isochronous bandwidth are then deallocated.

BUS RESET AND TERMINAL SHUTDOWN

Bus reset

After a bus reset, previously established channels and bandwidths have to be reallocated. According to the IEEE 1394 protocol new devices that wish to acquire isochronous resources not allocated prior to the bus reset shall wait a minimum of 1000 ms. Therefore, the ATSs are guaranteed to get the same resources they had prior to the bus reset. The

plug registers are not affected by a bus reset.

However, the Node IDs will not be the same after a bus reset since a new tree ID and self ID process have been carried out. The Node IDs are automatically determined depending on the current configuration of the network.

Thus, a bus reset does not require a new VPI value assignment, but it does require the RG to broadcast its new Node ID. Node IDs for each ATS also need to be updated in the VPI/Node ID table of the RG. This is solved by sending the connection control message immediately when the ATS has re-established the isochronous resources and has received the now Node ID of the RG. This message also instruct the RG to re-establish the downstream connection to the ATS (connecting their plugs). The ATS will also re-establish its upstream connection. Finally the ATS re-establishes its ILMI connectivity with the switch.

Terminal shut-down

When the terminal shuts down, the ILMI connectivity will be broken. The latter will be detected by the RG, which monitors all allocated VPs. After a specific time the allocated VP is released by setting the corresponding plugs off-line and setting the point_to_point field to the dummy value of 63. The switch also removes the ATS from its ILMI MIB.

PROTOCOL ARCHITECTURE

The protocol architecture between the ATS and the ATM switch is depicted in Figure 6. As can be seen in this Figure. ILMI and Q.2931 reside at the ATS and the switch. The CME runs directly of the link layer of IEEE 1394. It runs on the HAN only.

PERFORMANCE COMPUTATIONS

When choosing IEEE 1394 for the home network there is a trade-off between reach and bandwidth. The higher bit rates, 200-400 Mbps, are at the moment for the distance limited to 4,5 meters between devices (or repeaters), and for a maximum of 16 devices in a chain. This results in a total distance

of 72 meters between devices at the end points of the chain. For 100 Mbps, new versions of IEEE 1394 can go up to 100 meters between devices, which definitely is sufficient for the home (1600 meters between end points). The question is if 100 Mbps is enough for the home.

The useful bandwidth in IEEE 1394 depends on how the bus is organised. The isochronous cycle of 125 μs is divided into 6144 Bandwidth Units (BWUs). Isochronous traffic can use 80% of that bandwidth, i.e. 4915 BWUs. One BWU corresponds roughly to 20 ns. In a 100 Mbps bus I BWU is equivalent to 16 kbps. Thus the total available bandwidth for isochronous traffic is about 78 Mbps. Observe that due to the quadlet boundary of IEEE 1394 packets the minimum payload is one quadlet, which is equal to 256 kbps (16 BWU).

Three types of external services are expected to be transported over the home network, one-way video streaming, two-way real-time applications (e.g. video conferencing) and two-way non real-time applications (e.g. Internet). The following bandwidths are likely to be required for these applications:

- Video streaming (MPEG-2 SPTS) 3-10 Mbps
- Two-way real-time application: 2-3 Mbps bi-directional
- Two-way non-real-time applications: 2 Mbps bi-directional

As previously stated, the invention proposes that real-time traffic be transported in isochronous packets and that non-real-time traffic use asynchronous packets.

Previous DAVIC specifications define how ATM is to be transmitted over IEEE 1394 isochronous packets (see Figure 7). It is specified that an integer number of ATM cells are transmitted in an isochronous packet. Thus, you need to allocate isochronous bandwidth for at least one cell per isochronous cycle (125μs), even though you might not send a cell in each cycle. This results in the following possible channel bandwidths needed when transmitting ATM over isochronous packets:

1 cell/cycle:	Payload:	48 byte/125μs ⇒	3.072 Mbps
	Total:	80 byte/125μs ⇒	5.12 Mbps (320 MBUs)

2 cell/cycle:	Payload:	96 byte/125μs ⇒	6.144 Mbps
	Total:	140 byte/125μs ⇒	8.96 Mbps (560 MBUs)
3 cell/cycle:	Payload:	144 byte/125μs ⇒	9.216 Mbps
	Total:	200 byte/125μs ⇒	12.8 Mbps (800 MBUs)

It might be useful to allow a cell to be fragmented, in order to achieve higher bandwidth granularity when allocating ATM channels with less bandwidth than 3 Mbps. The price for doing that is increased overhead.

Due to delays caused by IEEE 1394 bus parameters, an overhead bandwidth needs to be allocated by each device that wishes to transmit isochronous data. If no device is capable of calculating the real overhead based on the current topology, a default (safe) value shall be used. This value equals 512 BWUs which of course is a waste of bandwidth in most cases. In the following calculations both the default value and a more realistic overhead (128 BWUs) are considered.

In Table 1 the needed bandwidths for transmitting ATM at different rates are shown. It also presents the number of channels which can be transmitted simultaneously at that rate over a 100 Mbps IEEE 1394 bus.

TABLE 1

ATM Payload	1394 BWUs	No of Channels (OH=512)	No of Channels (OH=128)
3.072	320	5	10
6.144	560	4	7
9.216	800	3	5

Bandwidth usage while transmitting ATM over IEEE 1394.

As can be seen, even though the default overhead is used, a customer can for instance watch one high quality movie (9 Mbps), one regular quality movie (6 Mbps) and have a video conference (3 Mbps bi-direction) simultaneously, and still have more than 30 Mbps available (maximum 14 Mbps for isochronous) for other internal or external services. If a more efficient allocation of overhead bandwidth is used, the

flexibility increases significantly. In the example above the user can simultaneously receive two 9 Mbps movies, two 6 Mbps movies, have a 3 Mbps bi-directional video conference and still have plenty of unused capacity. We definitely believe that this will satisfy the requirement of the majority of households.

MPEG-2/ATM/IEEE 1394 vs. MPEG-2/IEEE 1394

The main disadvantage of using ATM over IEEE 1394 is due to the required overhead. This is not exactly the case as we can see when comparing MPEG-2 transport over ATM in the home versus directly over IEEE 1394. MPEG-2 is transported over ATM as described in Figure 8.

In average 47 bytes per cycle is used for MPEG-2 packets. If we calculate the useful bit rate for transmitting MPEG-2 at the bit rates in Table 1 we get the following figures:

3.072 Mbps ATM $\Rightarrow$ 3.01 MPEG-2
6.144 Mbps ATM $\Rightarrow$ 6.02 MPEG-2
9.216 Mbps ATM $\Rightarrow$ 9.03 MPEG-2

When transmitting MPEG-2 directly over IEEE 1394 byte header is added to the 188 byte MPEG-2 packets to form a 192 byte source packet. This packet is subdivided into 4 data blocks of 48 bytes each. An integer number of data blocks is then transmitted in each cycle. Thus, in average 47 bytes per cycle are used for MPEG-2 in this case as well. The saved bandwidth is therefore equal to the ATM header (5 byte) plus the padding (3 byte). In Table 2 the needed bandwidths and the maximum number of channels for MPEG-2 directly over IEEE 1394 are shown. Comparing the two methods we can see that the capacity gain while terminating ATM in the RG and transmitting MPEG directly on IEEE 1394 is not substantial. Compared to the saved complexity when not terminating MPEG-2/ATM in the RG, we believe this is an acceptable loss. The RG will also become application independent.

1 data block/cycle:	MPEG-2:	47 byte/125μs	⇒ 3.01 Mbps
	Total:	72 byte/125μs	⇒ 4.608 Mbps (288 MBUs)
2 data block/cycle:	Payload:	94 byte/125μs	⇒ 6.02 Mbps
	Total:	124 byte/125μs	⇒ 7.936 Mbps (496 MBUs)
3 data block/cycle:	Payload:	141 byte/125μs	⇒ 9.03 Mbps
	Total:	176 byte/125μs	⇒ 11.264 Mbps (800MBUs)

TABLE 2

MPEG Payload	1394 BWUs	No of Channels (OH=512)	No of Channels (OH=128)
3	288	6	11
6	496	4	7
9	704	4	5

Bandwidth usage with while transmitting MPEG over IEEE 1394.

MULTI PROGRAM TRANSPORT STREAM

However, an open issue, is how to connect broadcast types of services (e.g. Satellite and Cable TV) to the IEEE 1394 network. The problem is that these systems use MPEG-2 MPTS, which requires a bandwidth of 38 Mbps. This corresponds to an allocation of 13 ATM cells per isochronous cycle (3200 BWUs).

The preferred solution is to extract the requested channel out of the MPTS and instead send it as an SPTS. However, this would require remultiplexing before entering the IEEE 1394 network, which is currently expensive and thus not possible. Instead of remultiplexing, one of the following solutions can be adopted.

1. If the customer chooses to watch a channel from such a system, there will only be 1587 BWUs (OH=128) left for other applications. This is for example enough for two 6 Mbps MPEG-2 channels.
2. We can introduce bridges which segment the traffic in the home.
3. Higher bit rate versions of IEEE 1394 can be chosen, but then the distance limitations must be solved.

Which alternative to choose is a subject for discussions. Our current opinion is to avoid the second alternative if possible in order to keep the home environment as simple as possible.

The above mentioned is only to be considered as advantageous embodiments of the present invention, and the scope of the invention is defined by the following claims.

CLAIMS

1. A transmission system comprising a first and a second network, **characterized** in that said networks share a common transmission technology, which technology carries said networks over the same physical bus.

2. A transmission system as claimed in claim 1, **characterized** in that said transmission technology is IEEE 1394.

3. A transmission system as claimed in claim 2, **characterized** in that said networks are two DAVIC logical networks.

4. A transmission system as claimed in claim 3, **characterized** in that said DAVIC logical networks are a Home Access Network (HAN) and a Home Local Area Network (HLN).

5. A transmission system as claimed in any of claims 1-4, **characterized** in that ATM cells are transported both in isochronous packets and in asynchronous packets, depending on a requested ATM service category.

6. A transmission system as claimed in any of claims 2-5, **characterized** in that delay sensitive ATM-service categories (e.g. CBR, real-time VBR) are transmitted in isochronous packets and non real-time traffic (e.g. UBR) in asynchronous packets.

7. A transmission system as claimed in any of claim 2-6, **characterized** in that all real-time VCs of a ATS are transported by two isochronous channels, one for each direction.

8. A transmission system as claimed in any of claim 2-7, **characterized** in that it constitutes a digital network which is implemented in households to interconnect all electronic equipment as for example PC, SET-TOP BOX, DVD-Player and stereo.

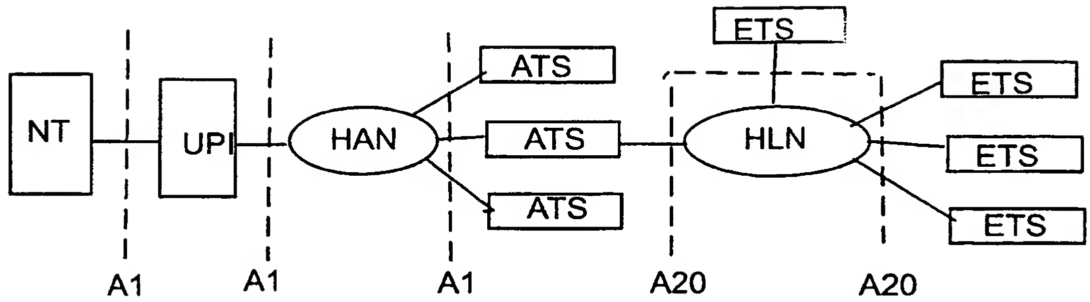

Fig 1

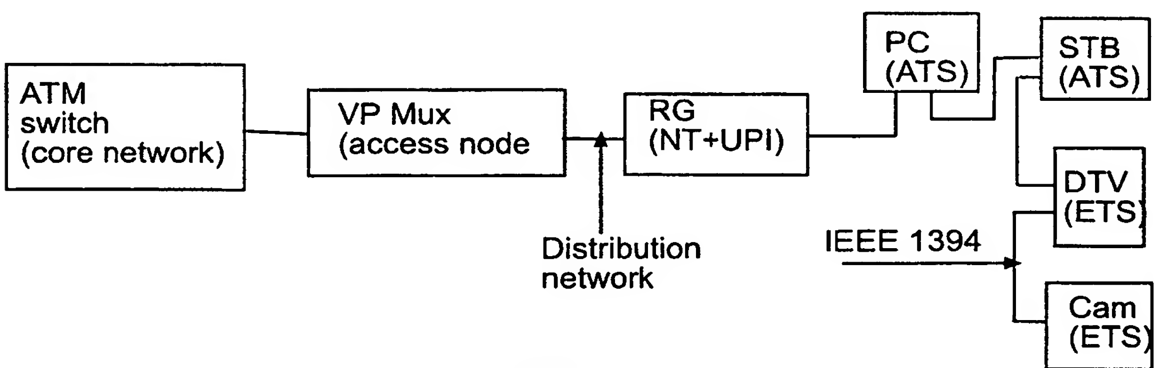

Fig 2

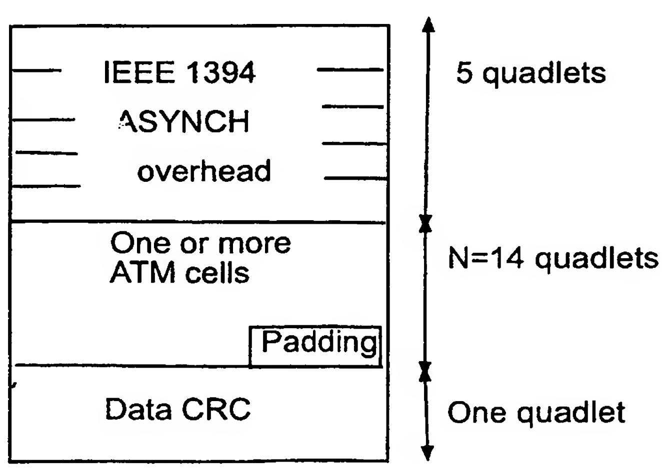

Fig 3

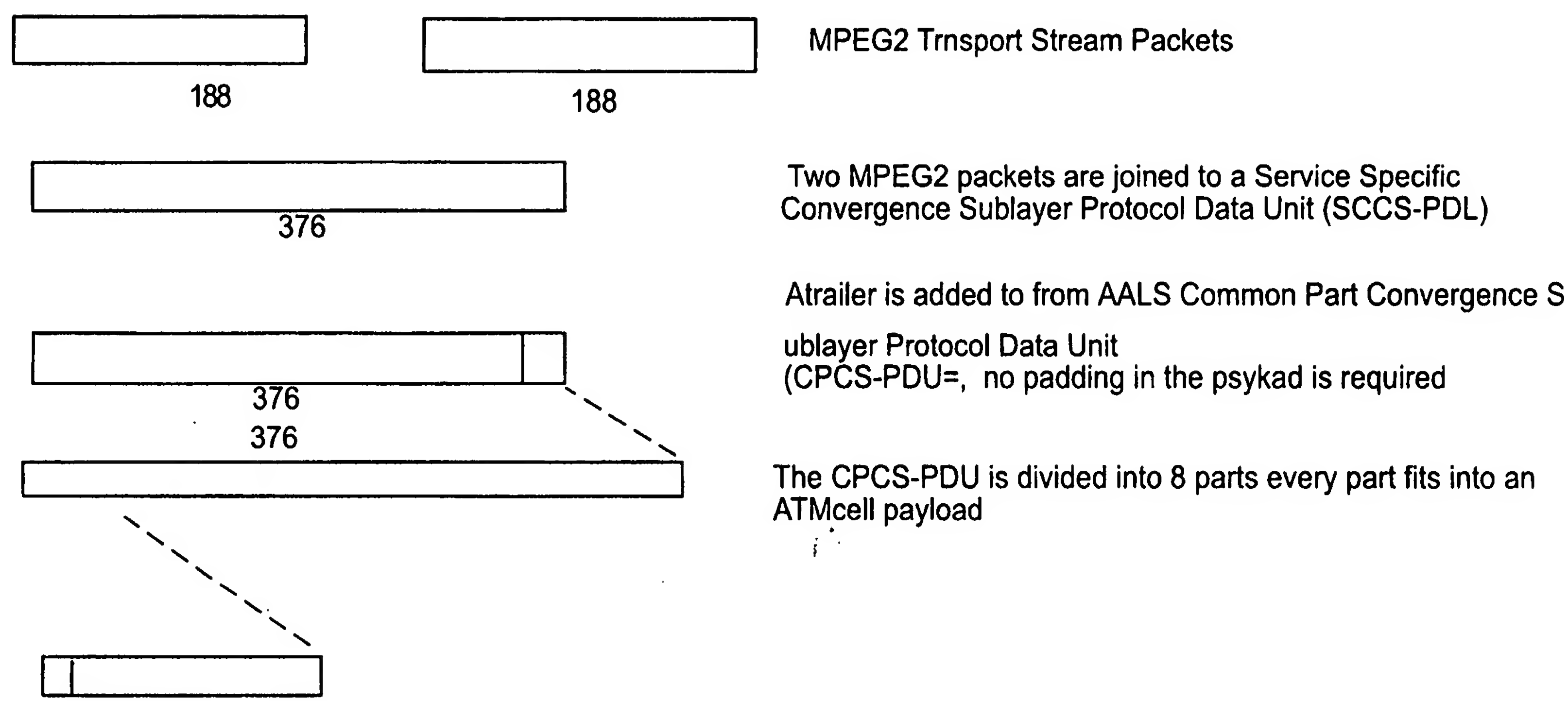
MPEG2 Trnsport Stream Packets
188
188
Two MPEG2 packets are joined to a Service Specific
Convergence Sublayer Protocol Data Unit (SCCS-PDL)
376
Atrailer is added to from AALS Common Part Convergence S
ublayer Protocol Data Unit
(CPCS-PDU=, no padding in the psykad is required
376
376
The CPCS-PDU is divided into 8 parts every part fits into an
ATMcell payload

Fig 8

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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : H04L 12/28, 12/40	A3	(11) International Publication Number: **WO 99/16213** (43) International Publication Date: 1 April 1999 (01.04.99)

(21) International Application Number: PCT/SE98/01661

(22) International Filing Date: 17 September 1998 (17.09.98)

(30) Priority Data:
9703442-5 24 September 1997 (24.09.97) SE

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(75) Inventors/Applicants *(for US only)*: CARLSSON, Conny [SE/SE]; Skärmarbrinksvägen 6,2 tr, S-121 35 Johanneshov (SE). NAZARI, Ala [SE/SE]; Dalarövägen 8, S-136 45 Haninge (SE). LARAQUI, Kim [SE/SE]; Verkstadsgatan 9, S-117 36 Stockholm (SE).

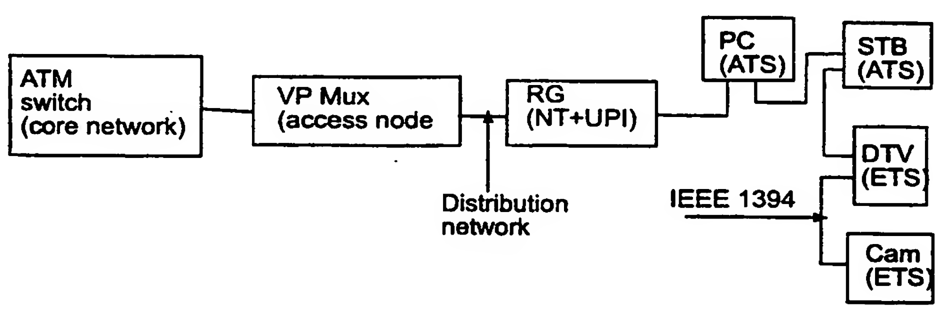
(74) Agent: PRAGSTEN, Rolf; Telia Research AB, Vitsandsgatan 9, S-123 86 Farsta (SE).

(81) Designated States: EE, JP, LT, LV, NO, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(88) Date of publication of the international search report: 12 August 1999 (12.08.99)

(54) Title: FIRST AND SECOND NETWORK SHARING A COMMON TRANSMISSION TECHNOLOGY OVER THE SAME PHYSICAL BUS



(57) Abstract

The invention relates to the use of one transmission technology for both Home Access Network and Home Local Area Network. The technology that is used for this is IEEE 1394, which carries two DAVIC logical networks over the same physical bus. With this transmission technology a home user can simultaneously watch multiple movies, have a video conference and still have capacity available for internal and external services.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 98/01661

A. CLASSIFICATION OF SUBJECT MATTER

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According to International Patent Classification (IPC) or to both national classification and IPC

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Minimum documentation searched (classification system followed by classification symbols)

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EDOC, WPIL, JAPIO, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 9728504 A1 (SONY ELECTRONICS, INC.), 7 August 1997 (07.08.97), page 1, line 12 - page 5, line 5, claims 1-9,58, abstract --	1-8
Y	Juhana Britschgi DAVIC Seminar on telecommunications technology Spring 1997, 25.04.1997 Retrieved from the Internet: <URL: http://www.cs.helsinki.fi/-britschg/ davic.html see whole Report --	1-8

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
27 May 1999	0 7 -06- 1999
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 98/01661

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Gary Hoffman and Daniel Moore IEEE 1394: A Ubiquitous Bus COMPCON'95 March 5 to 9, 1995 Retrieved from the Internet <URL: http://www.skipstone.com/compcon.html see whole Report --	1-8
A	Daniel Moore IEEE 1394: the Cable Connection to Complete the Digital Revolution 21st, VXM Technologies, inc. February 15, 1996 Retrieved from the Internet:<URL: http://www.skiptone.com/ss21st.html see whole Report --	1-8
A	US 5452330 A (FRED R. GOLDSTEIN), 19 Sept 1995 (19.09.95), column 1, line 5 - column 2, line 42, claims 1-3, abstract -- --------	1-8

INTERNATIONAL SEARCH REPORT

Information on patent family members

03/05/99

International application No.

PCT/SE 98/01661

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9728504 A1	07/08/97	AU 1855797 A	22/08/97
		CA 2244713 A	07/08/97
		EP 0877983 A	18/11/98
US 5452330 A	19/09/95	NONE	

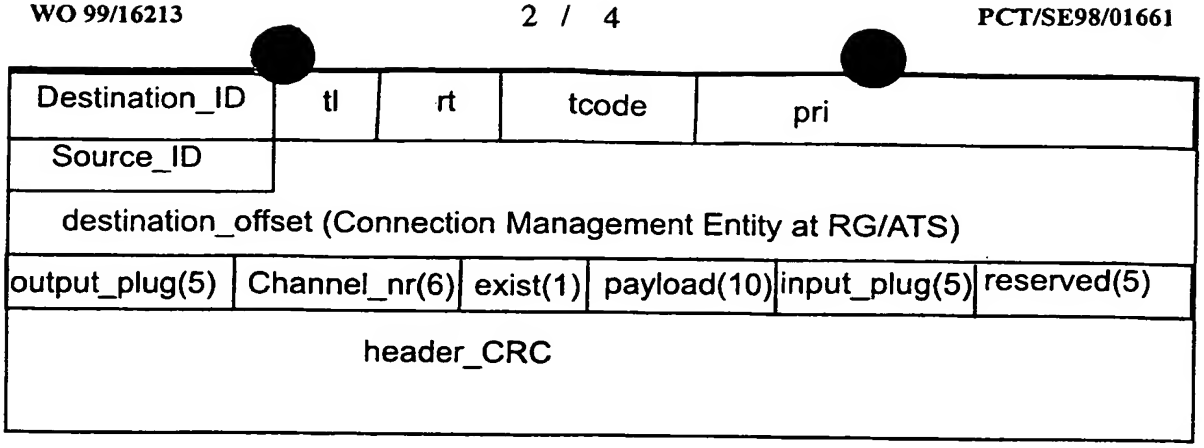
Destination_ID
tl
rt
tcode
pri
Source_ID
destination_offset (Connection Management Entity at RG/ATS)
output_plug(5)
Channel_nr(6)
exist(1)
payload(10)
input_plug(5)
reserved(5)
header_CRC

Fig. 4

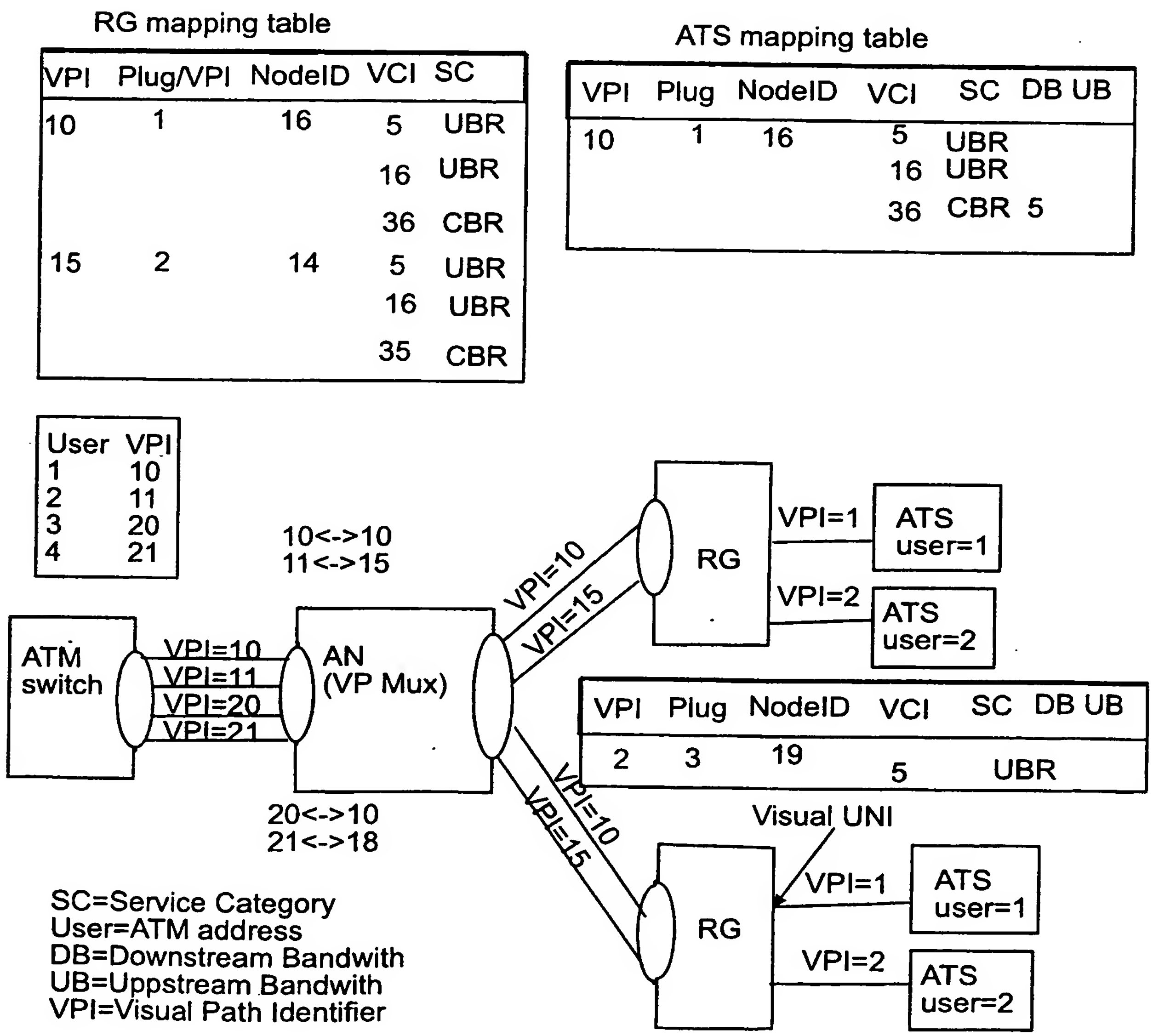
RG mapping table
VPI Plug/VPI NodeID VCI SC
10 1 16 5 UBR
16 UBR
36 CBR
15 2 14 5 UBR
16 UBR
35 CBR
ATS mapping table
VPI Plug NodeID VCI SC DB UB
10 1 16 5 UBR
16 UBR
36 CBR 5
User VPI
1 10
2 11
3 20
4 21
10<->10
11<->15
ATM switch
VPI=10
VPI=11
VPI=20
VPI=21
AN (VP Mux)
20<->10
21<->18
VPI=10
VPI=15
RG
VPI=1
ATS user=1
VPI=2
ATS user=2
VPI Plug NodeID VCI SC DB UB
2 3 19 5 UBR
Visual UNI
VPI=10
VPI=15
RG
VPI=1
ATS user=1
VPI=2
ATS user=2
SC=Service Category
User=ATM address
DB=Downstream Bandwith
UB=Uppstream Bandwith
VPI=Visual Path Identifier

Fig 5

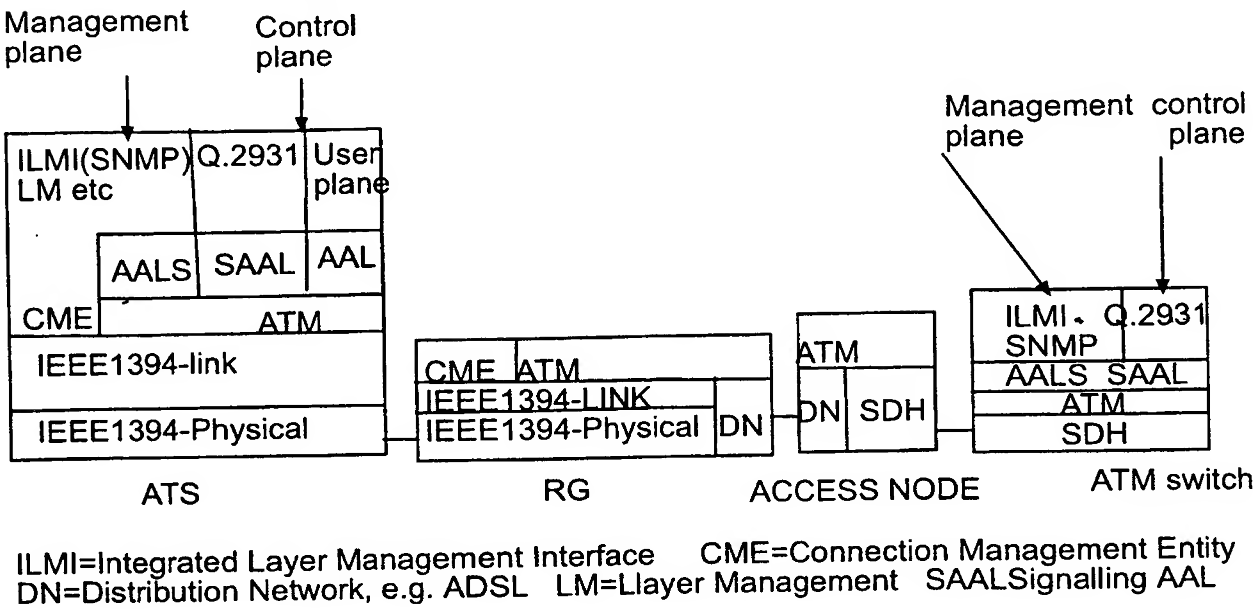
Management plane
Control plane
ILMI(SNMP) LM etc
Q.2931
User plane
AALS
SAAL
AAL
CME
ATM
IEEE1394-link
IEEE1394-Physical
CME
ATM
IEEE1394-LINK
IEEE1394-Physical
DN
ATM
DN
SDH
Management plane
control plane
ILMI SNMP
Q.2931
AALS SAAL
ATM
SDH
ATS
RG
ACCESS NODE
ATM switch
ILMI=Integrated Layer Management Interface CME=Connection Management Entity
DN=Distribution Network, e.g. ADSL LM=Llayer Management SAALSignalling AAL

Fig 6

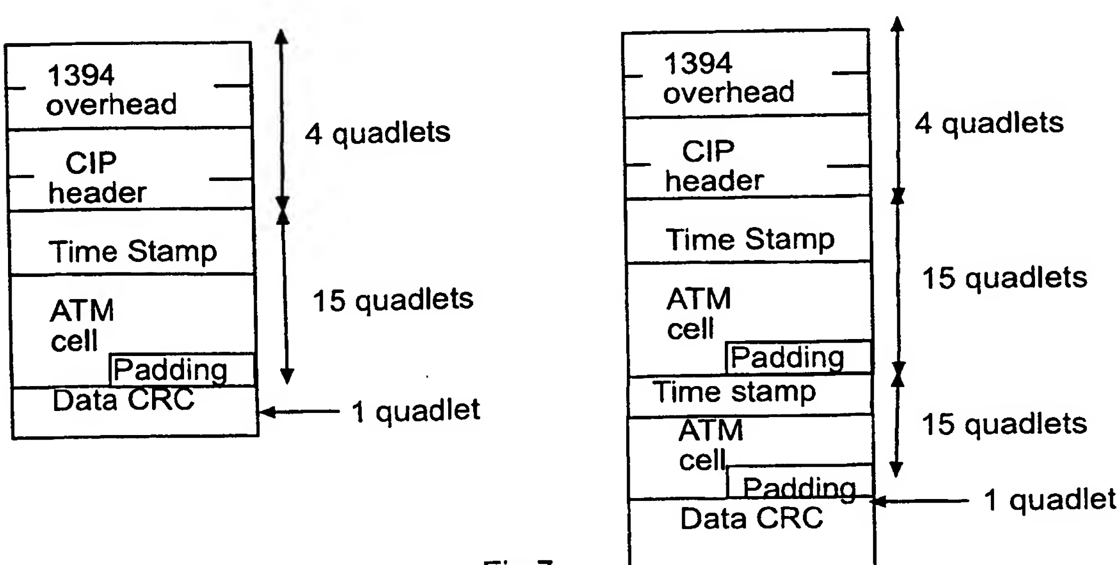
1394 overhead
CIP header
Time Stamp
ATM cell
Padding
Data CRC
4 quadlets
15 quadlets
1 quadlet
1394 overhead
CIP header
Time Stamp
ATM cell
Padding
Time stamp
ATM cell
Padding
Data CRC
4 quadlets
15 quadlets
15 quadlets
1 quadlet

Fig 7